

health and comfort and within the limits of reasonable economics.

(1) *Envelope penetrations.* Plumbing, mechanical and electrical penetrations of the pressure envelope not exempted by this part, and installations of window and door frames shall be constructed or treated to limit air infiltration. Penetrations of the pressure envelope made by electrical equipment, other than distribution panel boards and cable and conduit penetrations, are exempt from this requirement. Cable penetrations through outlet boxes are considered exempt.

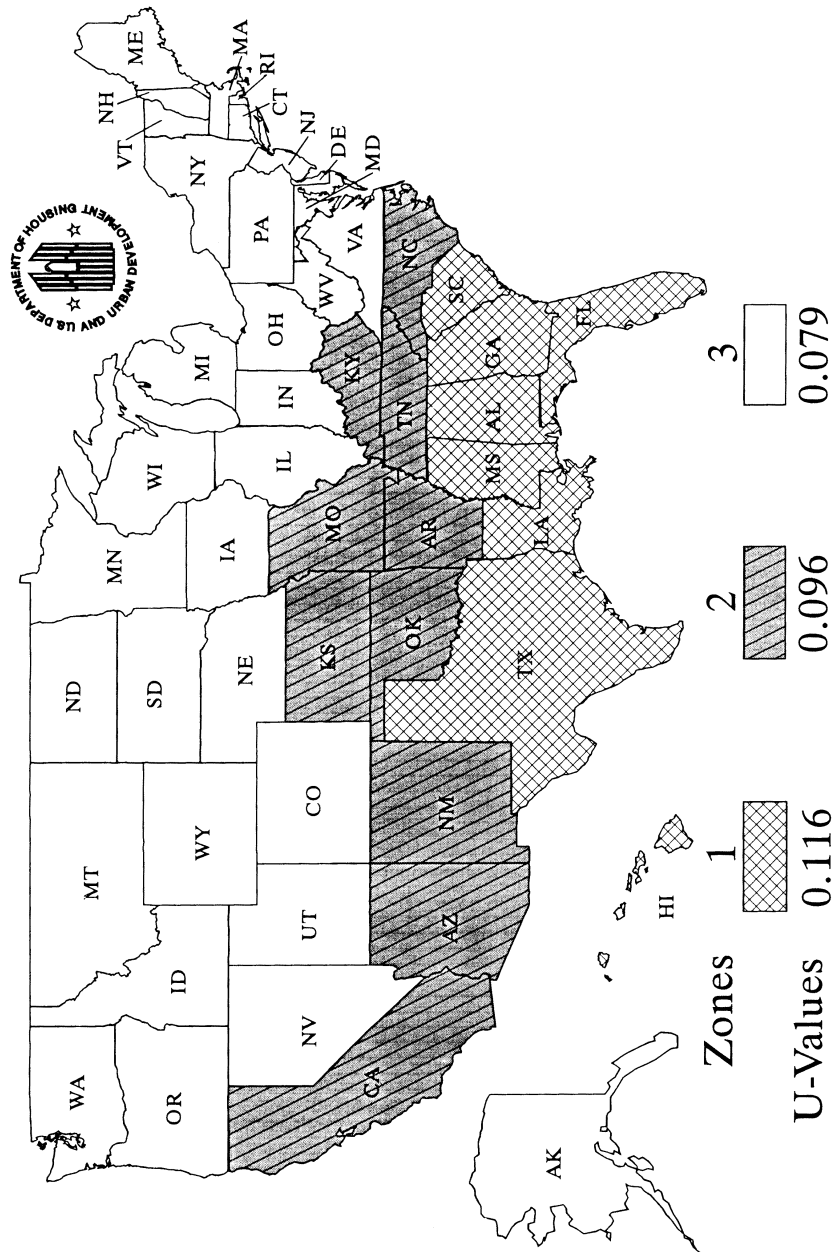
(2) *Joints between major envelope elements.* Joints not designed to limit air infiltration between wall-to-wall, wall-to-ceiling and wall-to-floor connections

shall be caulked or otherwise sealed. When walls are constructed to form a pressure envelope on the outside of the wall cavity, they are deemed to meet this requirement.

§ 3280.506 Heat loss/heat gain.

The manufactured home heat loss/heat gain shall be determined by methods outlined in §§ 3280.508 and 3280.509. The U_o (Coefficient of heat transmission) value zone for which the manufactured home is acceptable and the lowest outdoor temperature to which the installed heating equipment will maintain a temperature of 70 F shall be certified as specified in § 3280.510 of this subpart. The U_o value zone shall be determined from the map in figure 506.

U/O Value Zone Map for Manufactured Housing



(a) *Coefficient of heat transmission.* The overall coefficient of heat transmission (U_o) of the manufactured home for the respective zones and an indoor

design temperature of 70 F, including internal and external ducts, and excluding infiltration, ventilation and condensation control, shall not exceed

the Btu/(hr.) (sq. ft.) (F) of the manufactured home envelope are as tabulated below:

Uo value zone	Maximum coefficient of heat transmission
1	0.116 Btu/(hr.) (sq. ft.) (F).
2	0.096 Btu/(hr.) (sq. ft.) (F).
3	0.079 Btu/(hr.) (sq. ft.) (F).

(b) To assure uniform heat transmission in manufactured homes, cavities in exterior walls, floors, and ceilings shall be provided with thermal insulation.

(c) Manufactured homes designed for Uo Value Zone 3 shall be factory equipped with storm windows or insulating glass.

[58 FR 55009, Oct. 25, 1993; 59 FR 15113, Mar. 31, 1994]

§ 3280.507 Comfort heat gain.

Information necessary to calculate the home cooling load shall be provided as specified in this part.

(a) *Transmission heat gains.* Homes complying with this section shall meet the minimum heat loss transmission coefficients specified in § 3280.506(a).

§ 3280.508 Heat loss, heat gain and cooling load calculations.

(a) Information, values and data necessary for heat loss and heat gain determinations shall be taken from the 1989 ASHRAE Handbook of Fundamentals, chapters 20 through 27. The following portions of those chapters are not applicable:

- 21.1 Steel Frame Construction
- 21.2 Masonry Construction
- 21.3 Floor Systems
- 21.14 Pipes
- 21.16 Tanks, Vessels and Equipment
- 21.17 Refrigerated Rooms and Buildings
- 22.15 Mechanical and Industrial Systems
- 23.13 Commercial Building Envelope Leakage
- 25.4 Calculation of Heat Loss from Crawl Spaces

(b) The calculation of the manufactured home's transmission heat loss coefficient (Uo) shall be in accordance with the fundamental principals of the 1989 ASHRAE Handbook of Fundamentals and, at a minimum, shall address all the heat loss or heat gain considerations in a manner consistent with the

calculation procedures provided in the document Overall U-values and Heating/Cooling Loads—Manufactured Homes—February 1992—PNL 8006, HUD User No. 0005945.

(c) Areas where the insulation does not fully cover a surface or is compressed shall be accounted for in the U-calculation (see § 3280.506). The effect of framing on the U-value must be included in the Uo calculation. Other low-R-value heat-flow paths ("thermal shorts") shall be explicitly accounted for in the calculation of the transmission heat loss coefficient if in the aggregate all types of low-R-value paths amount to more than 1% of the total exterior surface area. Areas are considered low-R-value heat-flow paths if:

(1) They separate conditioned and unconditioned space; and

(2) They are not insulated to a level that is at least one-half the nominal insulation level of the surrounding building component.

(d) *High efficiency heating and cooling equipment credit.* The calculated transmission heat loss coefficient (Uo) used for meeting the requirement in § 3280.506(a) may be adjusted for heating and cooling equipment above that required by the National Appliance Energy Conservation Act of 1987 (NAECA) by applying the following formula:

$$U_o \text{ adjusted} = U_o \text{ standard} \times [1 + (0.6) \text{ (heating efficiency increase factor)} + \text{(cooling multiplier)} \text{ (cooling efficiency increase factor)}]$$

where:

Uo standard = Maximum Uo for Uo Zone required by § 3280.506(a)

Uo adjusted = Maximum Uo standard adjusted for high efficiency HVAC equipment
 Heating efficiency increase factor = The increase factor in heating equipment efficiency measured by the Annual Fuel Utilization Efficiency (AFUE), or the Heating Seasonal Performance Factor (HSPF) for heat pumps, above that required by NAECA (indicated as "NAECA" in formula). The formula is heating efficiency increase factor = AFUE (HSPF) home - AFUE (or HSPF) NAECA divided by AFUE (HSPF) NAECA.

Cooling efficiency increase factor = the increase factor in the cooling equipment efficiency measured by the Seasonal Energy Efficiency Ratio (SEER) above that required by NAECA.